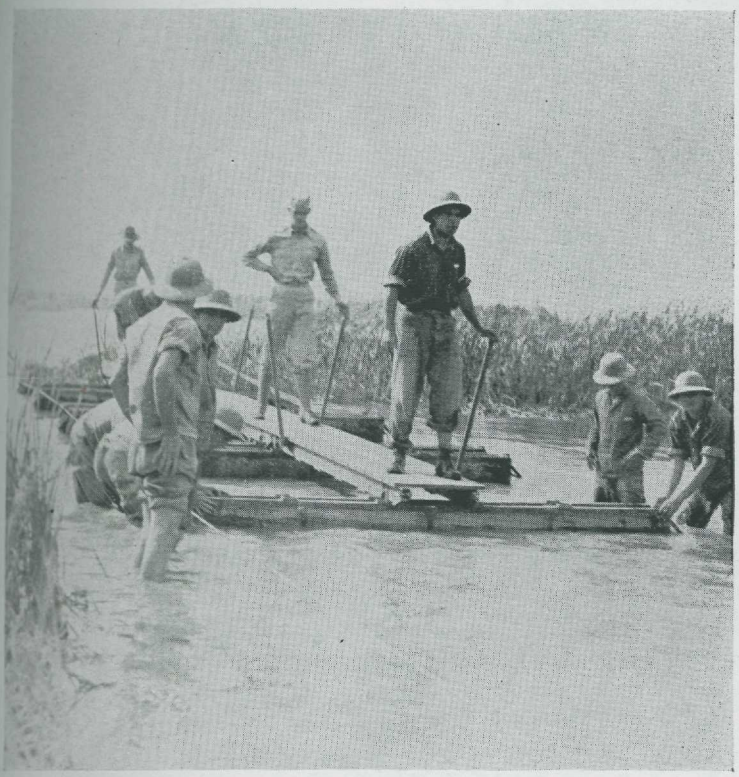

THE OHIO STATE ENGINEER

JUNE 1942

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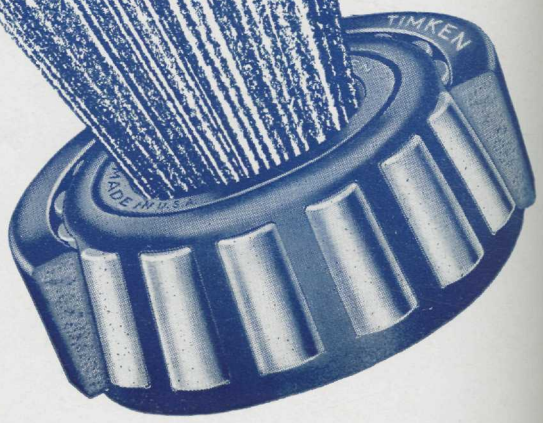
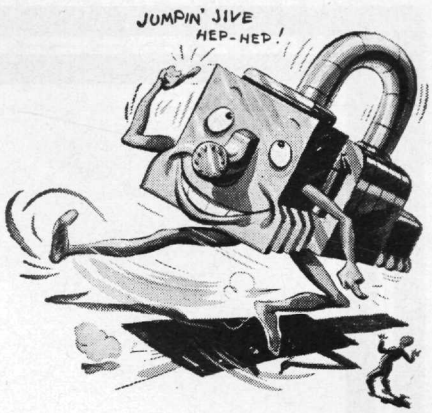


Once there was a jitterbug that weighed 800 tons!

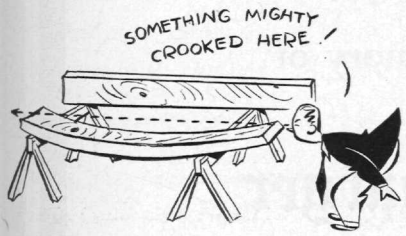


How Westinghouse Engineers Made Vibrating Turbine Generators Calm Down

WHEN the two-pole turbine generator came along, it was hailed as a great thing. And it was. It delivered enormous amounts of amps and volts, did a titanic electrical job. But . . .

Its rotor vibrated and endangered the alignment of the bearings, collector rings, and brushes. Its stator vibrated and made the foundations tremble. And, to make bad things worse, the vibrations were different from those found in the four-pole 1800-rpm machines—and they couldn't be eliminated by the usual balancing methods. Engineers had a tough problem on their hands.

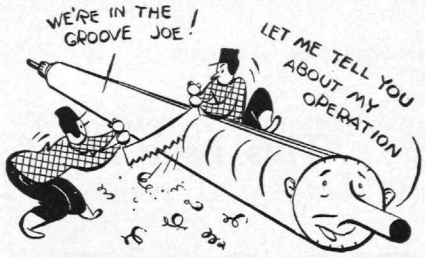
▶ Westinghouse engineers studied the rotor and found that it was acting like a two-by-four piece of wood. A two-by-four sags more lying flat than lying on its edge. It was the same with the long, slender, two-pole rotor. It sagged more lying one way than another.



This was why: Along two sides of the rotor, deep lengthwise slots were cut for the field windings. Naturally, the rotor had more give on the slotted sides than the solid sides. So, as the rotor turned, the give in the slotted sides made the downward force on the rotor supports change twice each revolution. The result: the rotor made the machine vibrate 120 cycles a second.

▶ What to do?

Dummy slots in the solid sections of the rotor would have equalized its rigidity. But Westinghouse engineers did something better. They cut several grooves across the solid sections. These grooves made the rotor's rigidity equal on all sides, *without disturbing the magnetic flux*. The turbine generator worked at top efficiency, the vibration at the supports was reduced 88%, the rings, brushes, and collector rings didn't take such a shaking-up.



▶ That took care of the rotor. But Westinghouse engineers also had to figure out what to do about the stator vibration.

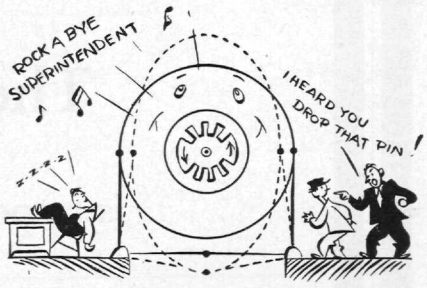
Massive as it is, the stator was being pulled out of shape, first on top and bottom, then on the two sides. The 400,000-pound magnetic force of the two-pole rotor was doing the pulling as it turned.

▶ Of course, the change in the stator's shape was too minute to be seen. But it could certainly be heard. For this change in shape was transmitted to the stator foundation as a 120 cycle vibration. From the foundation this vibration travels to floor and walls, making them hum.

To put a stop to it, Westinghouse engineers developed a special, flexible mounting for the stator. It is as though the stator were supported on two sets of links. One set goes along with the stator when it vibrates horizontally, but doesn't budge when the stator vibrates vertically. The other set goes along with vertical but not with horizontal vibrations.

▶ The effect of this ingenious arrangemen is that there is no motion at all where the links are attached to the stator foundation! The vibration at the supports is reduced by 75%, the noise lowered to less than ordinary power station noise levels!

The job was done. Stator vibration was absorbed. Rotor vibration was calmed down. Westinghouse engineers had 3600-rpm, two-pole turbine generators pouring out great electric power, and making no more vibration than machines running at half their speed.



▶ The electrical industry was through with that vibration trouble for good.

★ ★ ★

This is a typical Westinghouse story. It's typical because it's a story about engineers.

▶ There are 3500 engineers in Westinghouse. They're in all branches of the business . . . management, research, sales, design, service, testing. They shape the company's attitude toward its work.

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This issue of

The Ohio State Engineer

is respectfully dedicated to the memory of

Miss Sada A. Harbarger

Who Passed Away on April 23, 1942

for her services to the magazine and to the students of the College of Engineering.

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